

Update on L00 parametric CDM

The Helsinki Group

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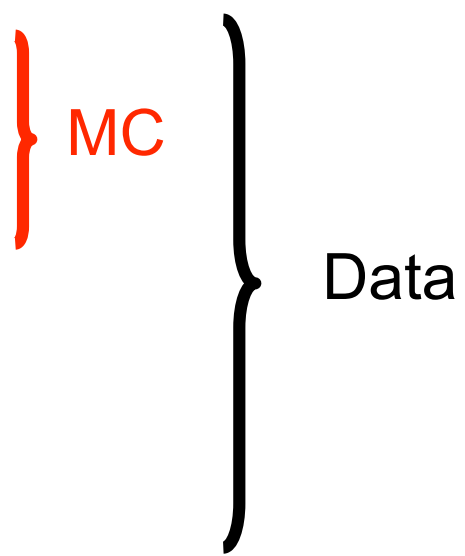
Status

- First report given on April 20th
 - Mainly trying to reproduce S. Carron's tuning of SVX
 - First look at Geometric model for L00
- Now update on SVX and L00 tuning
- Qualitative agreements obtained

Models

- Simulate the charge deposition and drift in L00, SVX and ISL
- **GEOMETRIC** model: is basic geometric description of the silicon system
- **PARAMETRIZED** model:
 - includes delta rays, charge diffusion in magnetic field, noise, capacitive coupling
 - Can be TUNED to describe real data

Data sample and cuts

- SiHitAnalyzer code in release 6.1.0
 - Compare 'fake track' simulation with $J/\Psi \rightarrow \mu \mu$ data (xpmm0d)
 - Track selections adapted from Sebastian:
 - COT: > 20 axial and stereo hits, > 50 total hits
 - $|\eta| < 1$
 - $0.5 < p_T < 1.5 \text{ GeV}$
 - $|D_{\text{new}}| = |d_0 - y_{\text{Beam}} \cos(\phi_0) + x_{\text{Beam}} \sin(\phi_0)| < 0.1 \text{ cm}$
 - $|z_0| < 60. \text{ cm}$
 - Fiducial: $|\phi_{\text{loc}}| < 0.25 \text{ rad}$, $|z_{\text{loc}}| < 6.0 \text{ cm}$
 - Track passes no overlap region
- 
- MC
- Data

Current tuning parameters

Phi-Side						
	L00	L1	L2	L3	L4	L5
Cross-talk	0.2	0.46 0.43 0.43	0.47 0.47 0.47	0.48 0.49 0.49	0.42 0.41 0.41	0.46 0.46 0.46
Gain	2.1	2.1 1.9 2.1	2.1 1.9 2.1	1.9 1.7 1.9	2.1 1.9 2.1	1.9 1.7 1.9
Offset	-13	-13 -12 -13	-12 -12 -13	-12 -15 -12	-13 -12 -13	-11 -15 -12

— Helsinki

— Sebastian

— Repository

Current tuning parameters

Z-Side						
	L00	L1	L2	L3	L4	L5
Cross-talk	--	0.16 0.20 0.20	0.17 0.19 0.19	0.51 0.51 0.51	0.22 0.24 0.24	0.50 0.50 0.50
Gain	--	1.7 2.0 1.7	1.7 2.0 1.7	2.2 1.7 2.2	1.7 2.0 1.7	2.2 1.7 2.2
Offset	--	-14 -22 -16	-14 -22 -16	-14 -17 -15	-14 -22 -16	-14 -17 -15

Results

- Tuning of 3 parameters(gain, offset and cross-talk) is generally done on 3-4 distributions: Strip multiplicity, charge distribution, hit residual, **average noise**
- Are on the web: home.fnal.gov/~remortel
- Will be updated regularly
- Will be quantified (χ^2)

The plots

Phi-side

Z-side

Strips Charge Noise Resid

L00

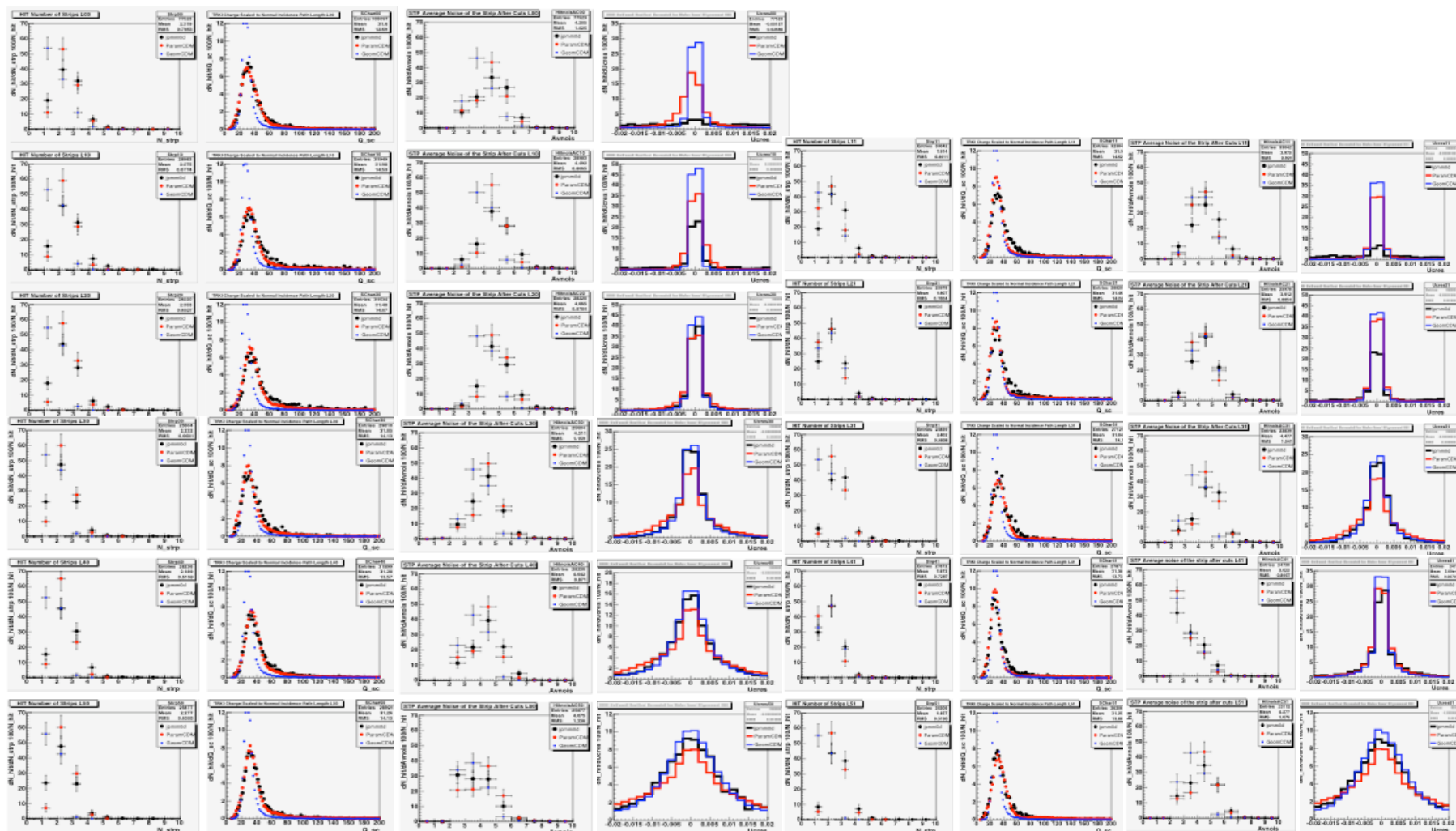
L1

L2

L3

L4

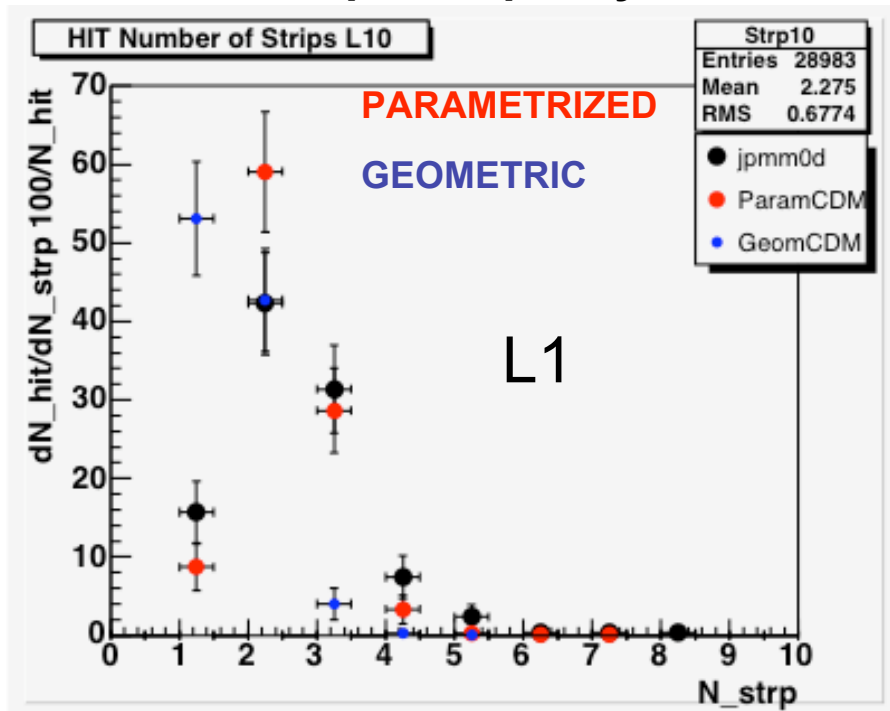
L5



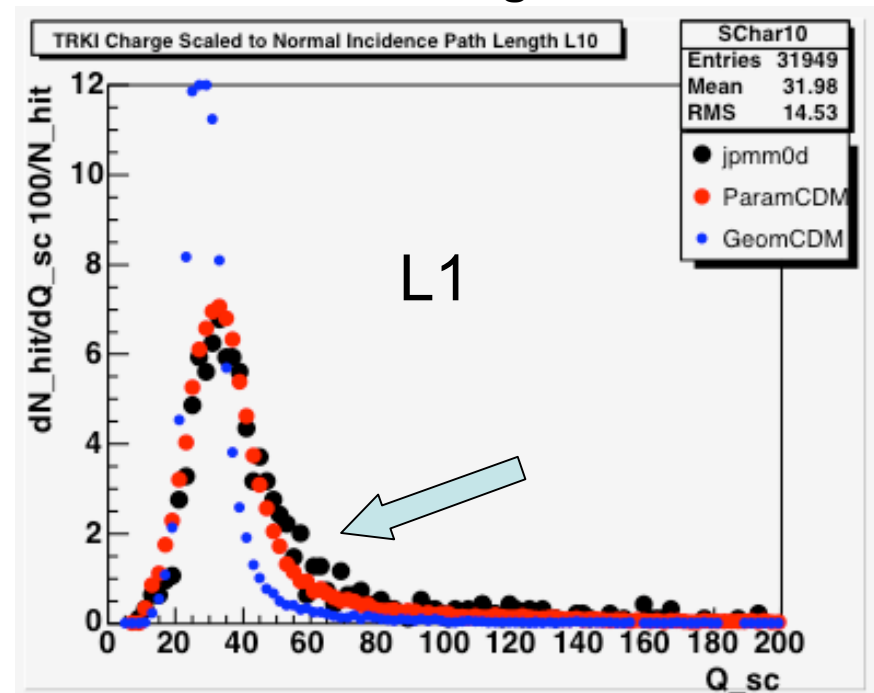
SVX tuning in detail

Phi-side

Strip multiplicity



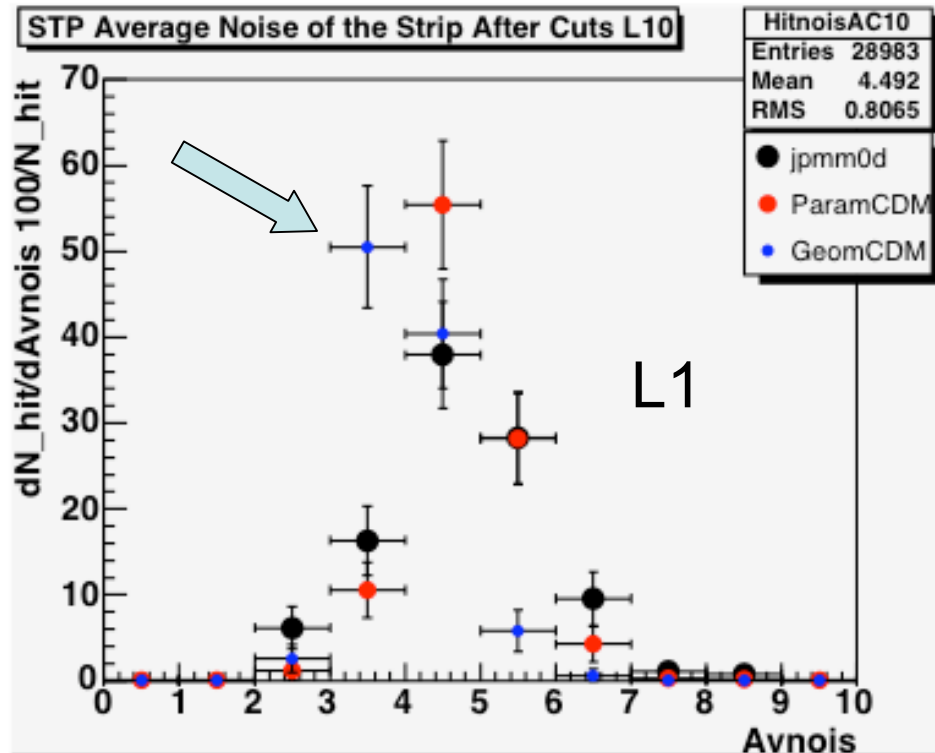
Scaled Charge



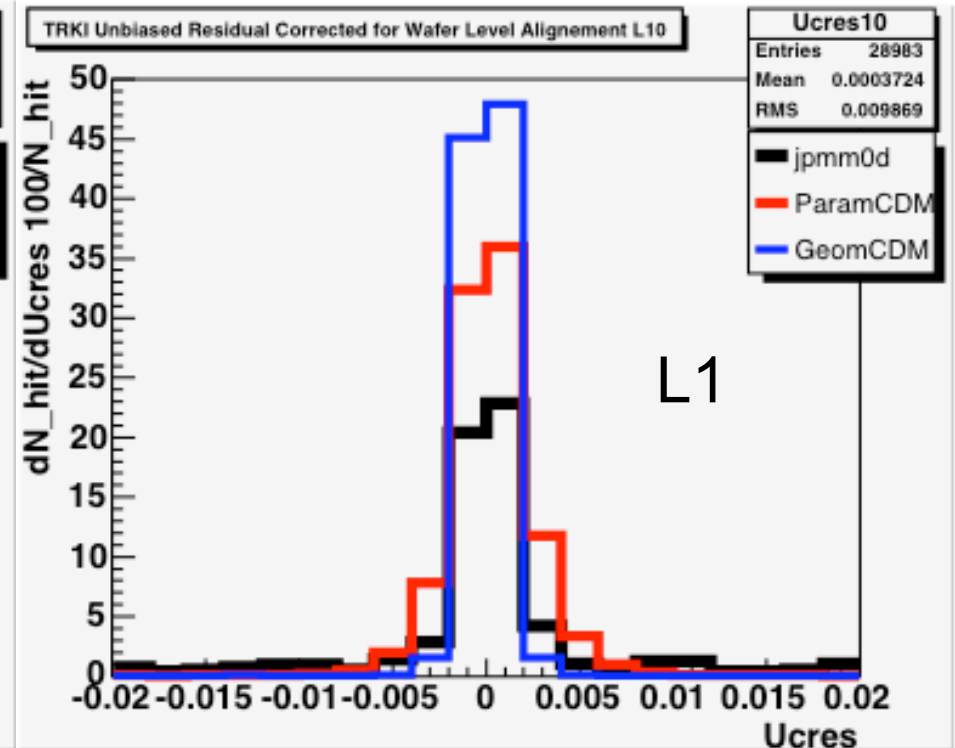
- Strip multiplicities are lower in Geom. Model, Parametrized does a good job
- Scaled Charge = $Q \cdot \sin(\theta)$ is too narrow and peaks at too low values for Geom. Model, Parametrized gives a good description, except for the tail

Phi-side

Average noise



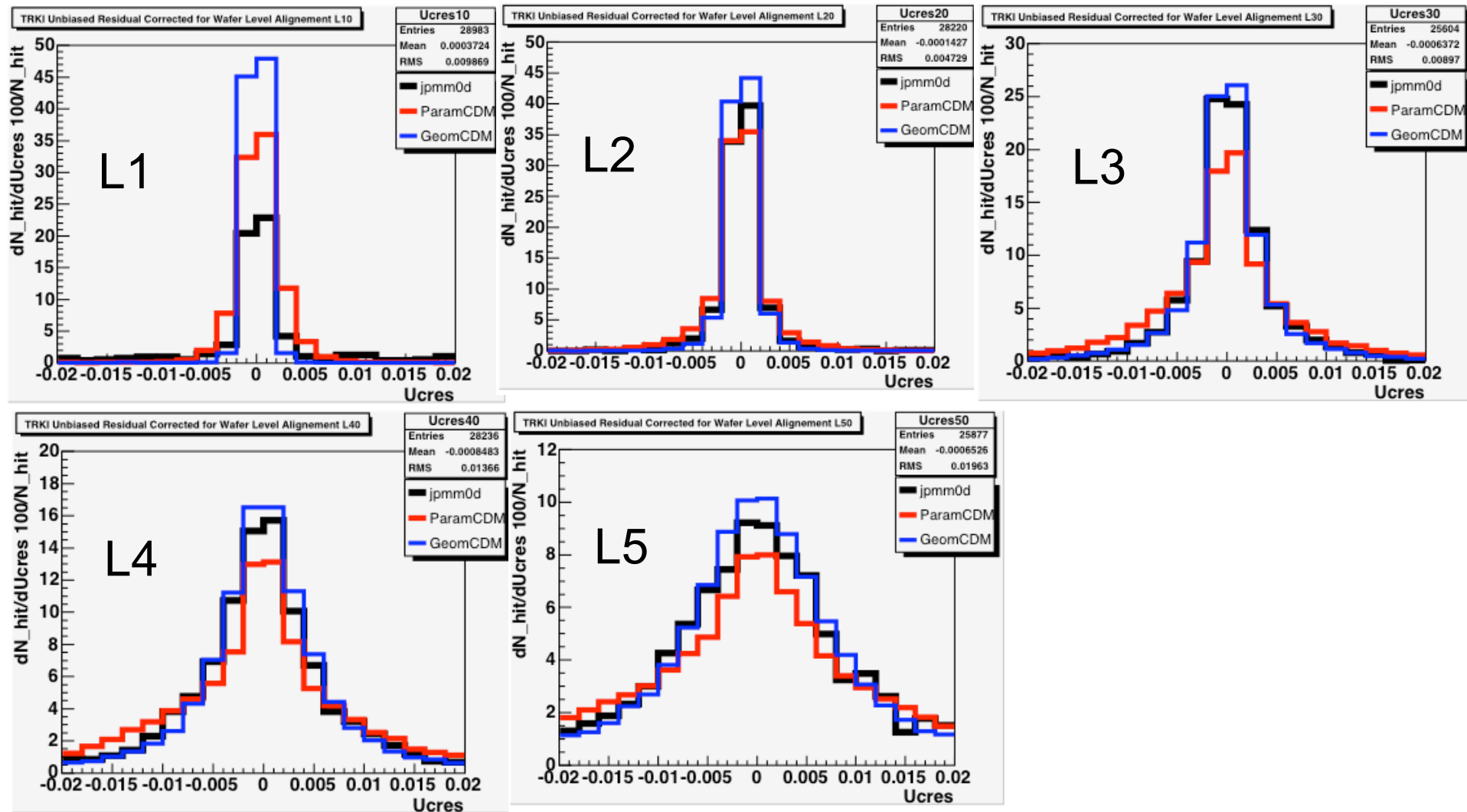
Unbiased corrected residual



- Parametrized CDM gives also a better description of the noise
- Both models underestimate the hit resolution, parametrized does better job than geometric. Agreement becomes better for outer layers.

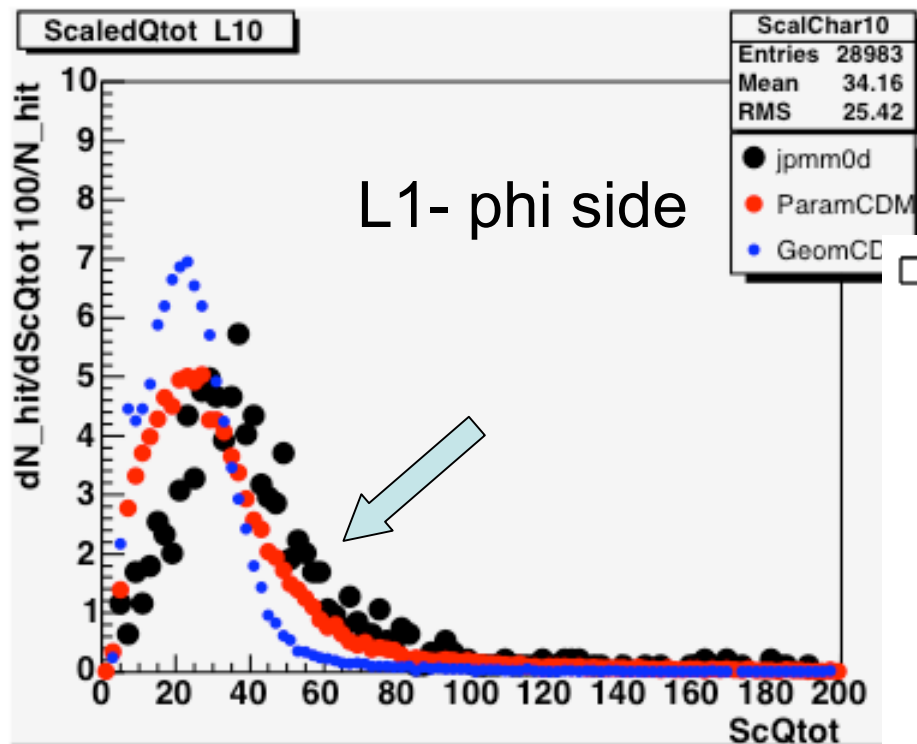
Unbiased residuals corrected for alignment

Phi-side

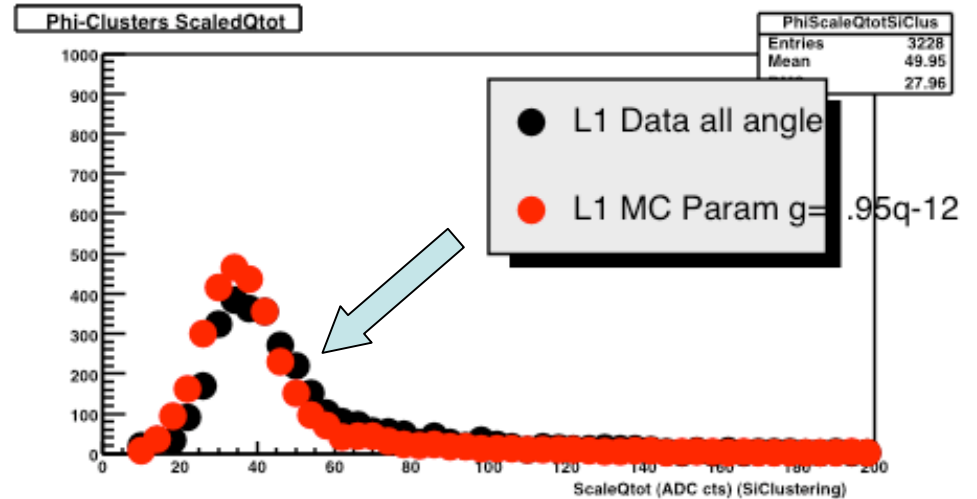


Charge Scaled for normal incidence at WAFER

Scaled wafer charge



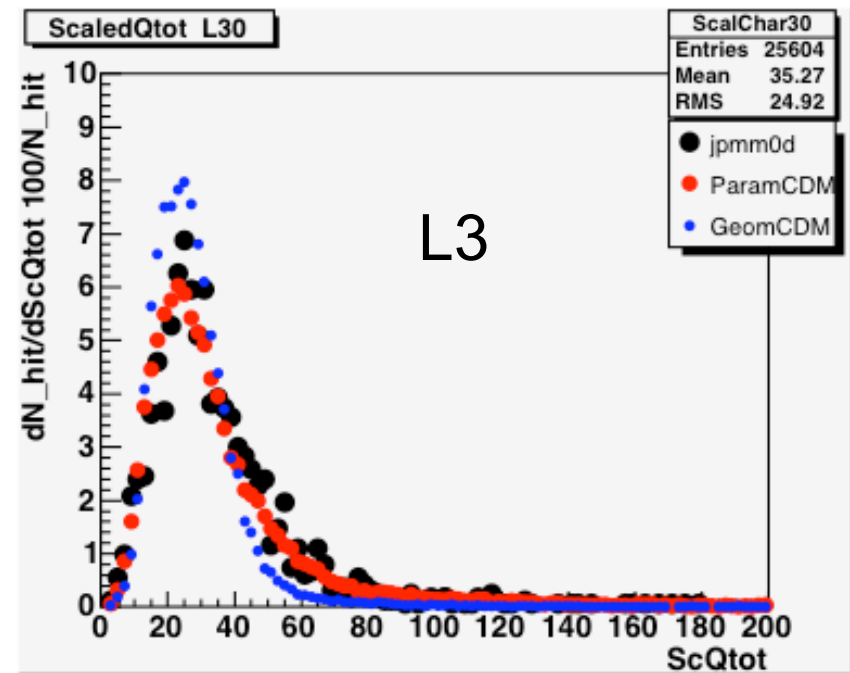
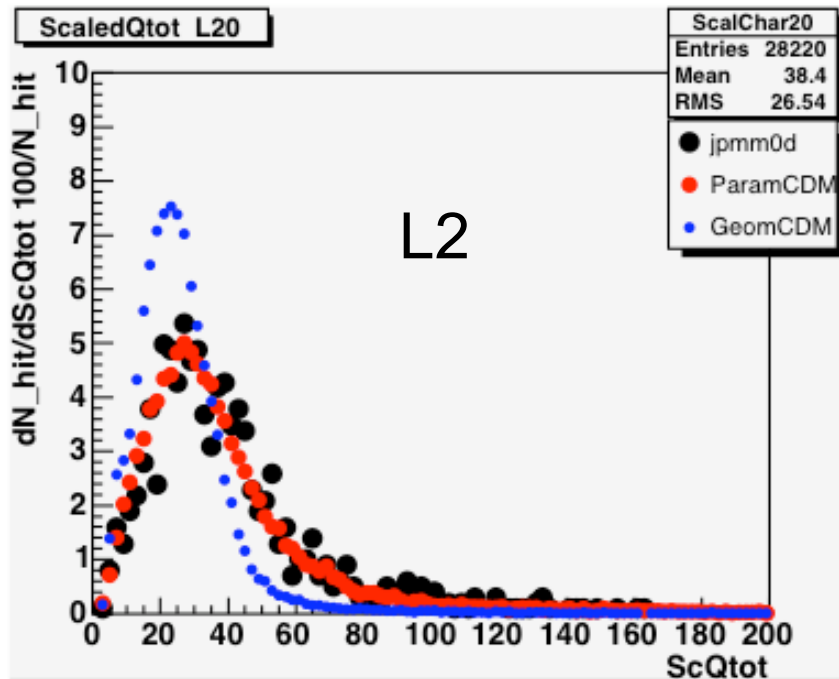
S. Carron



- Seems to be most **sensitive** to the tuning
- Similar deviations were observed by Sebastian

Charge Scaled for normal incidence at WAFER

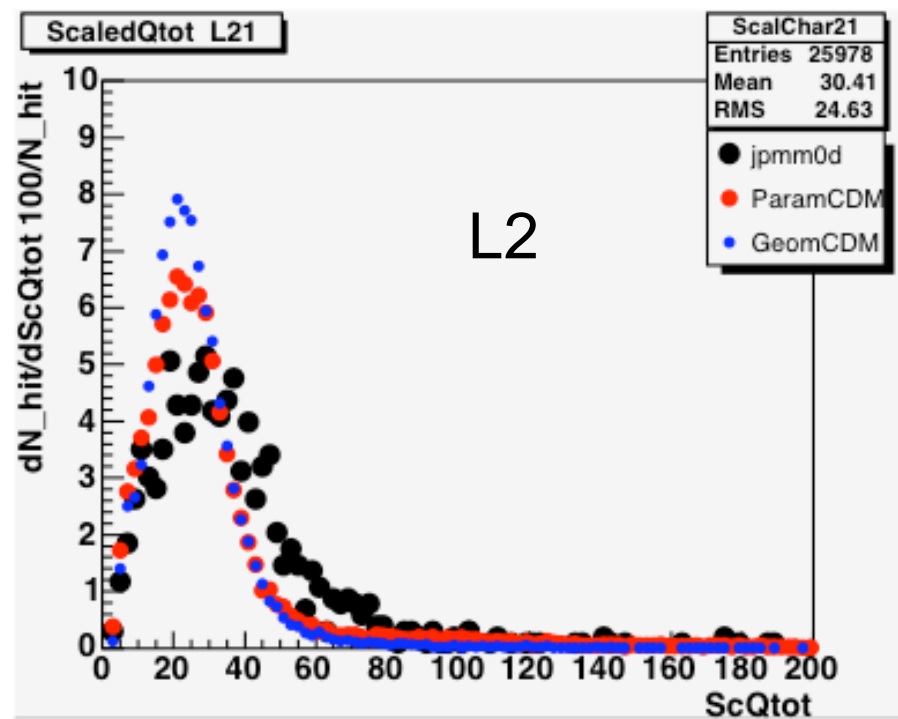
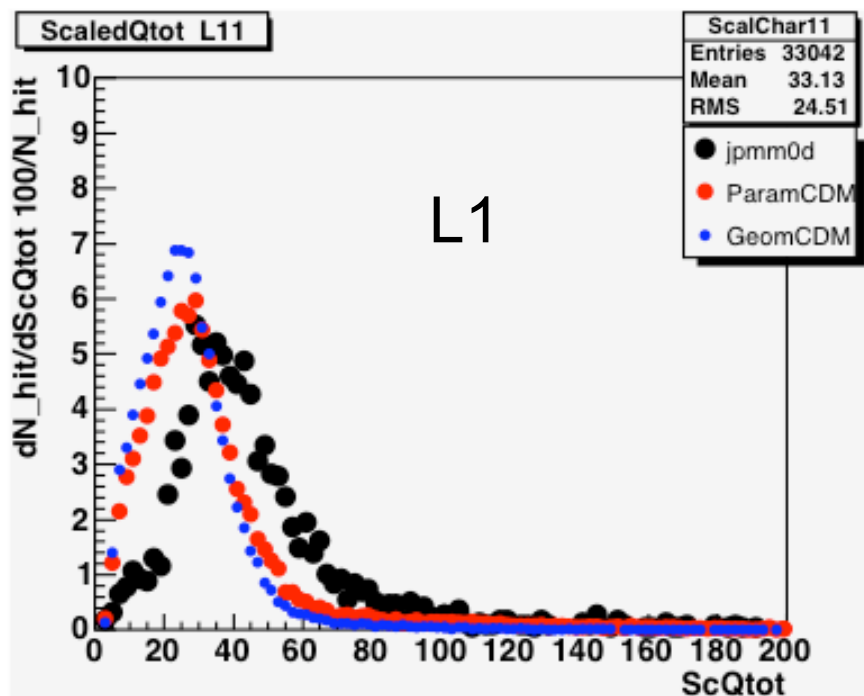
Phi-side



L2 → L5 are very well described by parametrized CDM!

Charge Scaled for normal incidence at WAFER

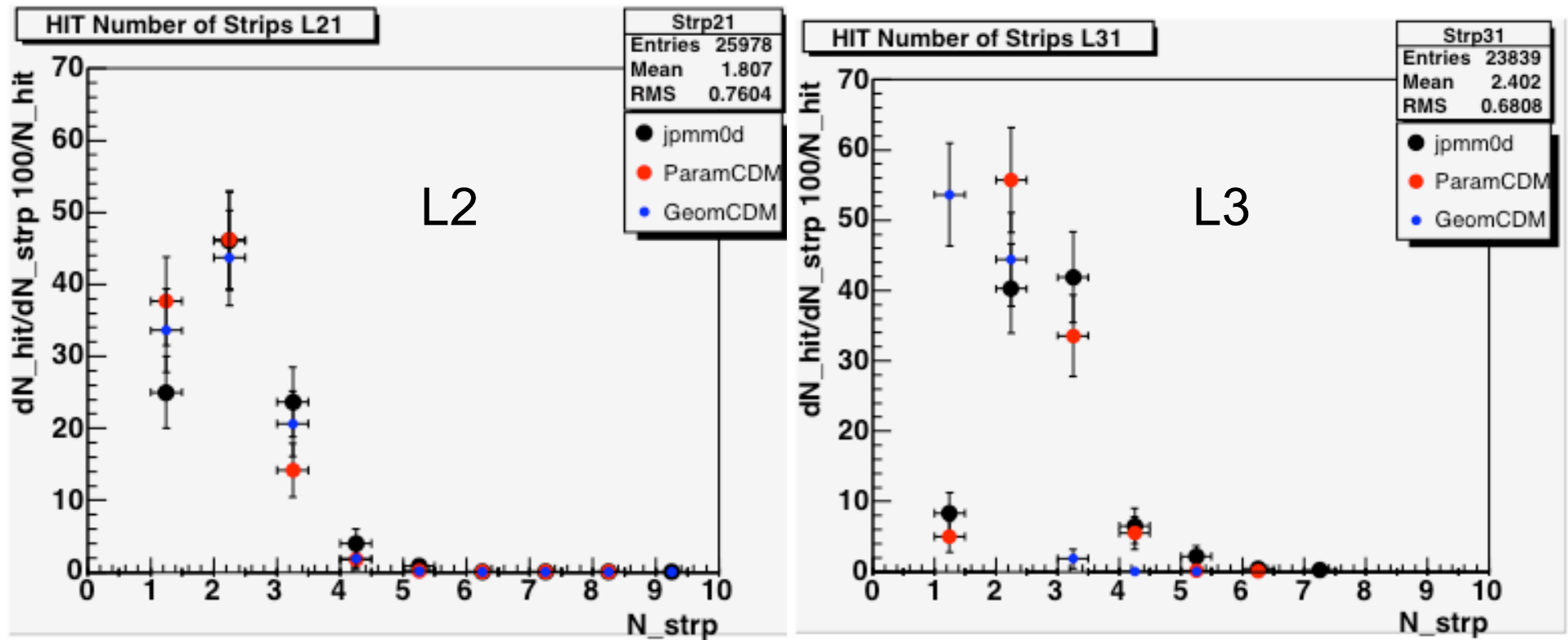
Z-side



Scaled Charge of Layers 1 and 2 are badly described, others are good

Strip Multiplicity

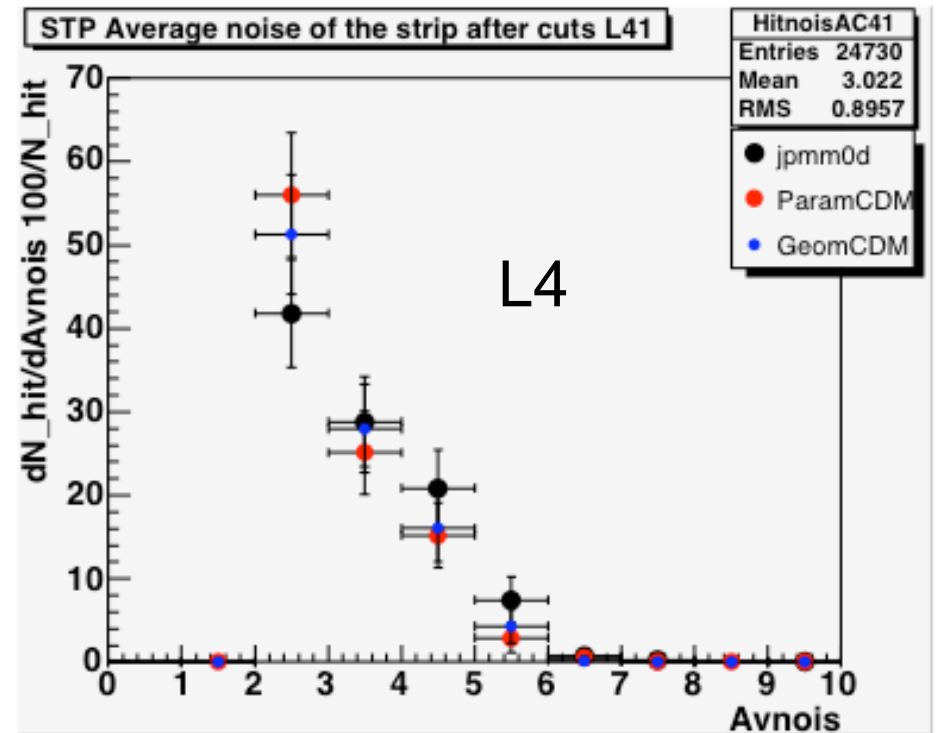
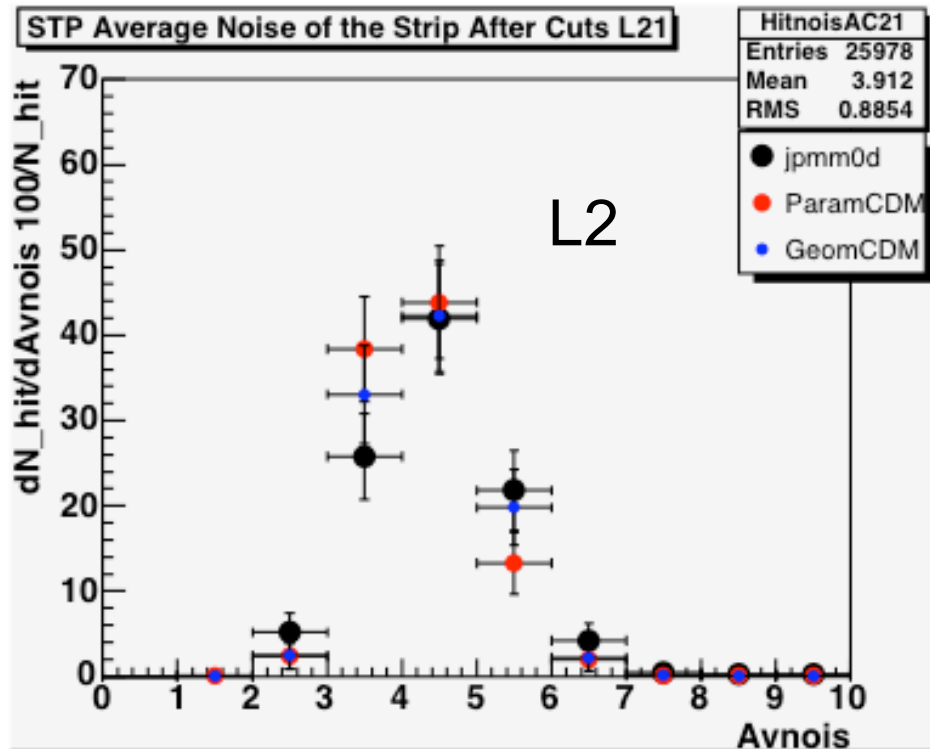
Z-side



Strip multiplicities on Z-side show in general no problems (less sensitive)

Average Noise

Z-side

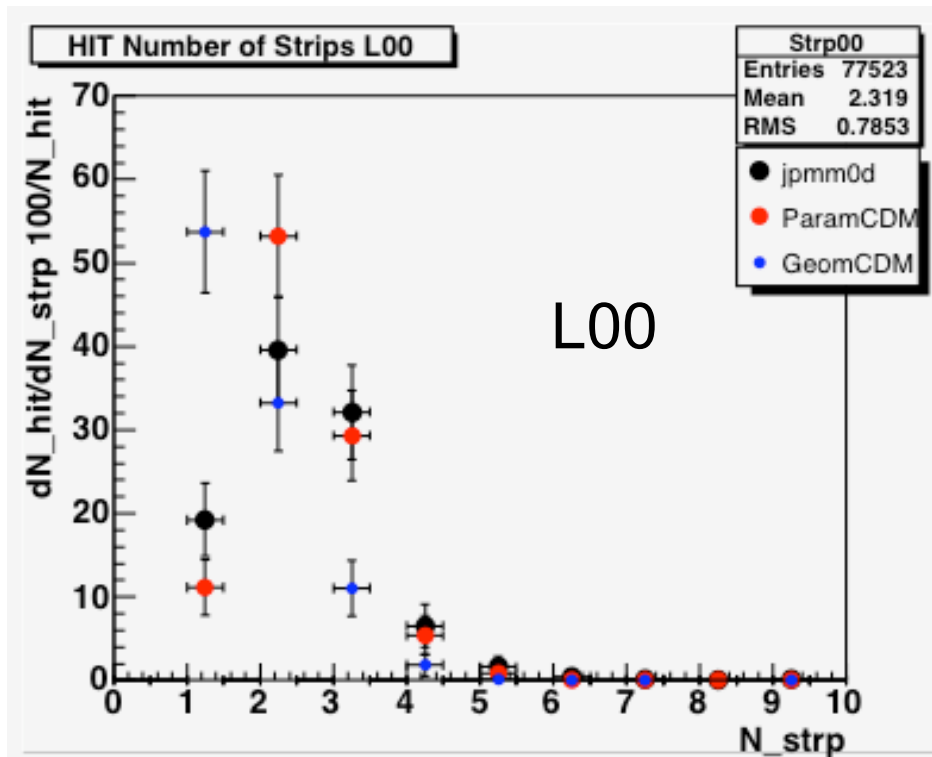


- Funny noise distribution for layer 4, well reproduced by models

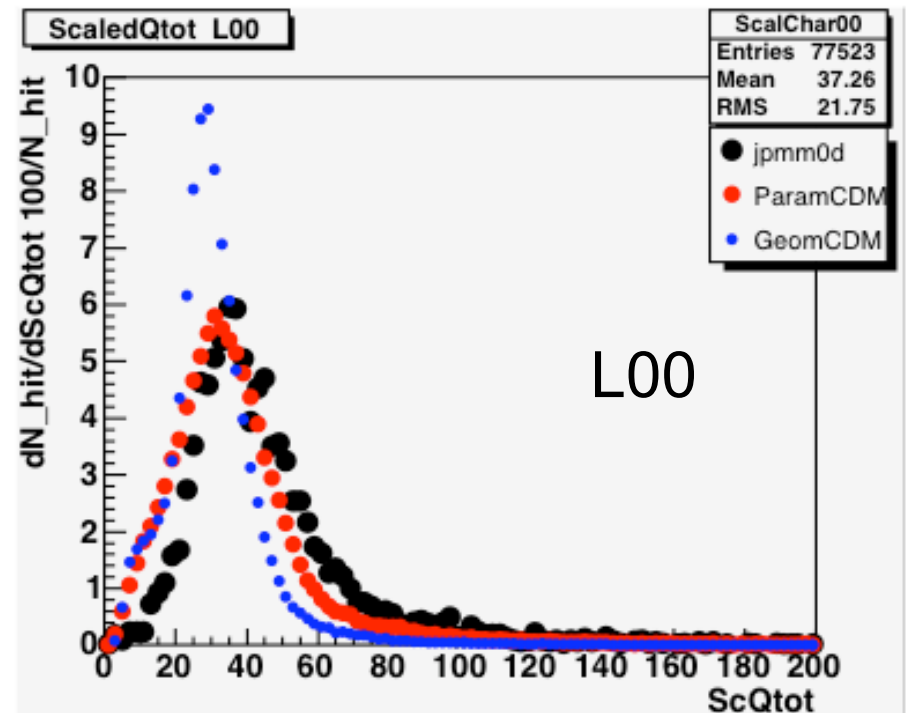
Layer 00

- Parametrized CDM was not implemented for L00
- Should be ported from SVX
- Looking into the code, parametrized CDM for L00 can be switched on and gives good description of the data!

Strip multiplicity

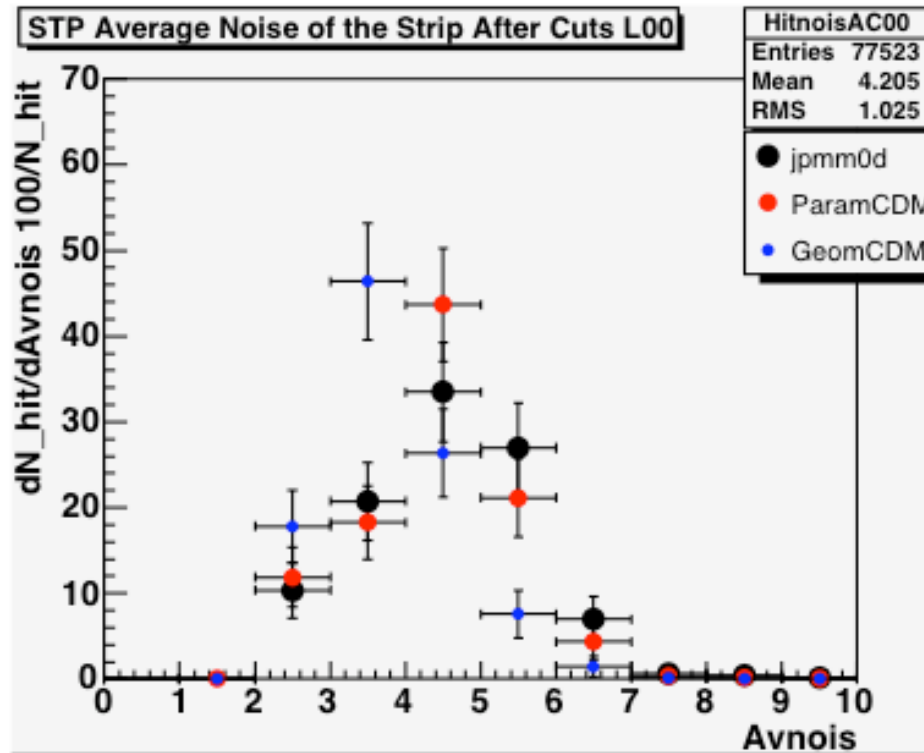


Scaled WAFER Charge

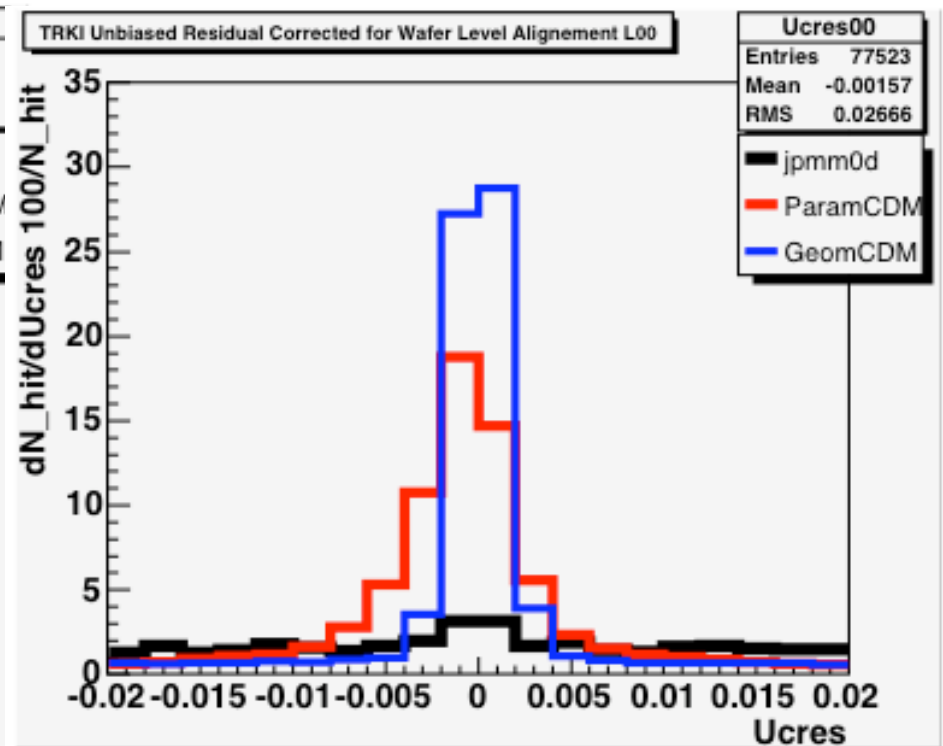


Layer 00 continued

Average noise



Unbiased corrected residual



Hit residuals are largely underestimated by the models

Conclusion

- We're getting close to Sebastian's results for SVX
- Most layers are well described by Parametrized CDM (L1-L2 typically worse than others)
- Parametrized CDM for L00 seems already (completely?) transported

Plans

- Make tuning quantitative! Minimum χ^2 .
- Continue to investigate L00 Parametric CDM
- Look deeper into description per ladder, wafer, ..
- Use identified muons and loosen other track cuts
- Look at other data (different momentum spectra)